Utah Department of Environmental Quality
Division of Solid and Hazardous Waste

Human Health Risk Assessment
Review Draft

Executive Summary

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Deseret Chemical Depot
Tooele Chemical Agent Disposal Facility (TOCDF)
EPA I.D. No. UT 5210090002

Permitting Authority:

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EXECUTIVE SUMMARY

In this risk assessment, the Utah Department of Environmental Quality, Division of Solid and Hazardous Waste (DSHW), evaluates the potential for adverse health effects that could result from exposure to emissions from the treatment of chemical munitions at the Tooele Chemical Agent Disposal Facility (TOCDF) and the Chemical Agent Munitions Disposal System (CAMDS) located at the U.S. Army Deseret Chemical Depot (DCD). This executive summary is written for the layperson that is interested in the findings of the human health risk assessment but may not have the technical background necessary to fully understand the methods and terms used. The executive summary includes additional information not found in the full report. The reader is encouraged to study both the executive summary and full report to have the most complete understanding of the conclusions and limitations of the risk assessment.

The DSHW uses risk assessment as a tool for evaluating the protectiveness of hazardous waste operating permits. This risk assessment is an update of the 1996 *Screening Risk Assessment* (ATK, 1996). Since the release of the *Screening Risk Assessment*, new information, such as emissions testing results, has become available from the TOCDF. This risk assessment was conducted using updated methods recommended by the U.S. Environmental Protection Agency (U.S. EPA). The U.S. EPA (1998) methods intend to overestimate the potential for health effects by assuming protective factors for (1) calculating emission rates for chemicals of potential concern (chemicals), (2) evaluating exposure, and (3) assessing chemical toxicity. The specific procedures used for the risk assessment are presented in the January 2001 *Final Human Health Risk Assessment Protocol for Deseret Chemical Depot, Tooele Chemical Agent Disposal Facility* (Tetra Tech 2001b), that was made available for public review. The risk assessment will continue to be updated as new information becomes available and periodically reports will be released that document the updates.

Six potential emissions sources at the TOCDF were evaluated in the risk assessment: (1) liquid incinerator 1 (LIC 1), (2) LIC 2, (3) the metal parts furnace (MPF), (4) the

deactivation furnace system (DFS), (5) the heating, ventilation, and air conditioning (HVAC) system, and (6) the brine reduction area. The brine reduction area is not active; however, it was evaluated should it become operational in the future. There are four potential sources at CAMDS that were evaluated: (1) the MPF, (2) the DFS, (3) the LIC, and (4) the HVAC system. The LIC and DFS are currently not operational; however, they were evaluated should they become operational in the future. Detailed descriptions of the units, their processes, and their emission rates are presented in the risk assessment protocol. Summaries of these descriptions are presented in this report.

Methods

The risk assessment uses hypothetical exposure scenarios that are not intended to represent any individual person. Using hypothetical exposures is a way to avoid underestimating potential exposures. The hypothetical exposure scenarios assume that a person is exposed to chemicals from more exposure pathways and at higher concentrations than is likely for any actual person. The hypothetical exposure scenarios evaluated include a subsistence rancher, a resident, a worker at DCD (on-site worker), a water skier at the SunTen lake, a recreationist at Rush Lake, and a fisher at Rainbow Reservoir. Both an adult and child were evaluated for each exposure scenario except for the on-site worker. The risk assessment estimated potential daily intake rates for each chemical to evaluate the following exposure pathways:

- Acute inhalation was evaluated for the resident, on-site DCD worker, and rancher. Acute exposures are short-term, such as one hour.

- Chronic inhalation was evaluated for the resident, on-site DCD worker, and rancher. Chronic exposures are long-term, such as 30 years.

- Unintentional ingestion of soil was evaluated for the resident, the on-site DCD worker, and rancher.

- Ingestion of drinking water from surface water sources was evaluated for the resident and the rancher.

- Unintentional ingestion of surface water from Rush Lake and SunTen ski pond during recreation was evaluated.

- Ingestion of homegrown produce, beef, mutton, pork, poultry, eggs, cow's milk, and goat's milk was evaluated for the rancher.

- Eating fish from Rush Lake and Rainbow Reservoir was evaluated for the recreationist.

- Ingestion of polychlorinated dioxins and furans (dioxins) in breast milk was evaluated for the infant of a resident, rancher, and on-site worker.

The risk assessment evaluated more than 300 chemicals that might be released including chemicals that were never detected in stack emissions. The emission rates for these chemicals are measured at the smokestack. Computer modeling is used to estimate how much of the chemicals could potentially get from the smokestack and into media (such as air, water, soil, food). Emission rates for this risk assessment were based on stack testing conducted at the TOCDF and CAMDS when this data was available. For stack testing yet to occur (for instance, TOCDF has not started mustard processing), emission rates were estimated from a similar facility such as the Johnston Atoll Chemical Agent Disposal System (JACADS). Chemicals that were not detected were assumed to be emitted at the analytical detection limit; these chemicals might not actually be present in stack emissions.

Both the potential for cancer health effects and non-cancer health effects (such as impaired kidney function) were estimated. The calculated potential for health effects was compared to U.S. EPA standards that are called target levels. The U.S. EPA target levels adopted by the DSHW are: an excess lifetime cancer risk of one in one-hundred

thousand (1×10^{-5}), for chronic non-cancer effects a hazard index of 0.25, and for acute non-cancer effects a hazard index of one (1.0). A one in one-hundred thousand excess lifetime cancer risk means that if one hundred thousand people were exposed, there could be up to one additional case of cancer over a lifetime. For comparative purposes, it is estimated that approximately forty thousand cancer cases are expected over a lifetime for a U.S. population of one hundred thousand people (NCI, 2002). For non-cancer effects, the hazard index is a comparison of the potential dose of chemicals from emissions to a U.S. EPA safe dose. When the hazard index is one, the potential dose is equal to the safe dose. A hazard index less than one means the potential dose is less than the safe dose. A hazard index greater than one means that the potential dose exceeds the safe dose. The U.S. EPA (1994) recommends a hazard index of 0.25 (the potential dose from emissions is 75 percent lower than the safe dose) to account for potential chemical exposures from sources other than DCD. For example, people near DCD could be exposed to mercury from past mining activities in addition to mercury from the DCD incinerators.

If the calculated cancer risk and hazard indices are less than the target levels, the conclusion is that potential exposures to emissions are safe. Safe in this context means that the risks are below a level that requires regulatory intervention. Calculated values greater than the target level indicate that potential exposures to emissions **may** be unsafe. To conclude that emissions are unsafe requires additional investigation because the risk assessment methods are intended to overestimate the potential for adverse health effects. Additional investigation includes an in-depth evaluation of the chemicals and exposure pathways that exceed the target levels. If emissions are determined to be unsafe after the additional investigations, changes can be made to how the incinerators are operated through the hazardous waste operating permit until the emissions are safe. If emissions cannot be made safe, the permit could be revoked.

Summary of Results

With the exception of five chemicals, potential exposures to emissions from the TOCDF and CAMDS are safe and need no additional investigation. The emissions of ethyl methanesulfonate (EMS), two polyaromatic hydrocarbons (PAHs) dibenz(a,h)anthracene

and indeno(1,2,3-cd)pyrene, di-n-octylphthalate (DNOP), and mercury were identified as being potentially unsafe and additional investigation was warranted.

The source of the potentially unsafe exposure to EMS was through drinking water for a resident and a rancher. EMS has never been detected in stack emissions at the TOCDF, CAMDS, or JACADS, and has not been detected in the waste processed. EMS is not expected to form during the combustion process. EMS is not stable in water or the atmosphere and is very unlikely to persist in the environment, especially in drinking water. Based on these facts, the potential exposures to EMS are likely overestimated and concluded to be safe.

The sources of the potentially unsafe exposures to PAHs were through homegrown milk and beef for a rancher. Currently, no one in the vicinity of DCD is known to consume homegrown milk. The PAHs dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene have never been detected in stack emissions at the TOCDF, CAMDS, or JACADS, nor are they known to be present in the waste streams but related chemicals (other PAHs) have been detected in emissions at CAMDS and JACADS. For estimating the potential exposures by homegrown milk and beef, no metabolization of PAHs was assumed. This assumption results in an overestimate of the concentrations of PAHs in beef and milk because cows would metabolize PAHs (assuming that PAHs are actually present) and the process of metabolization would reduce the amount of PAHs in beef and milk. Based on the lack of detections in stack emissions and overestimations of concentrations in food, potential exposures to PAHs are concluded to be safe. Additional investigation that includes monitoring will be conducted. Additional details on monitoring are provided in the Future Actions section.

The sources of the potentially unsafe exposures to DNOP were through homegrown milk and beef for a rancher. DNOP has never been detected in stack emissions at the TOCDF or JACADS but was detected once at CAMDS. DNOP is not expected to form during the combustion process. Although DNOP has not been detected in the waste processed, other phthlates are present. For estimating the potential exposures from homegrown milk

and beef, no metabolization of DNOP was assumed. This assumption results in an overestimate of the concentrations of DNOP in beef and milk because mammals metabolize DNOP (assuming that DNOP is actually present) and the process of metabolization would reduce the amount of DNOP in beef and milk. Based on the single detection in stack emissions and overestimations of concentrations in food, potential exposures to DNOP are concluded to be safe. Additional investigation that includes monitoring will be conducted. Additional details on monitoring are provided in the Future Actions section.

The sources of potentially unsafe exposures to mercury were through the ingestion of fish and unintentional ingestion of soil. Mercury has been detected in incinerator stack emissions. The brine reduction area, where water would be evaporated from pollution abatement system liquids, was the source of over 99 percent of the mercury predicted in fish and soil. The brine reduction area is not in operation and is not anticipated to operate. As long as the brine reduction area does not operate, mercury emissions from the brine reduction area are zero. Prior to being permitted to operate, the brine reduction area must conduct testing that includes measuring emissions. The results of the emissions testing will be evaluated in the risk assessment prior to the brine reduction area being permitted to operate.

Based on the amounts of mercury observed in stack emissions at the TOCDF, mercury has been the subject of additional sampling and analyses of the wastes. Since the pollution abatement system used to scrub stack gases at the TOCDF and CAMDS is not effective at capturing mercury, an accurate understanding of the amount of mercury in the waste is essential to predicting releases of mercury from the stack. Mercury has been detected in GB and as a residue in the bottom of ton containers at the TOCDF. GB ton containers with high levels of mercury were washed out prior to incineration to avoid the potential of releasing the mercury in stack emissions. The operating permit has also been modified to reduce the amount of mercury that can be processed. The reductions in mercury emissions as a result of these activities has not been taken into account in this assessment but will be factored into future assessments.

Stack testing methods do not differentiate between the different forms of mercury. The risk assessment evaluates three types of mercury that differ in toxicity: elemental mercury, mercuric chloride, and methyl mercury. Methyl mercury is not released from incinerators but methyl mercury could be formed from other types of mercury released to lakes and streams. Predicting the concentration of mercury in fish and soil from the concentration measured in stack emissions has many uncertainties. The concentrations of the different types of mercury were predicted using U.S. EPA recommended methods that likely overestimate the potential health risks.

Methyl mercury is the source of potentially unsafe exposures to the fisher and recreationist. Methyl mercury is the most toxic of the three forms of mercury evaluated and is the type expected in fish. Exposures to the fisher and recreationist assumed fish consumption levels appropriate for a subsistence fisher (a person whose protein diet consists of mostly fish) because little data could be found on consumption rates for recreational fishers in Tooele County. The fish consumption rates, and therefore exposures, are likely overestimated for recreational fishers. Fish consumption surveys will be conducted if Rainbow Reservoir opens for fishing.

An additional source of overestimation was that all fish were assumed to be caught from Rush Lake or Rainbow Reservoir. Rush Lake cannot support a sport fishery but was used as an overestimate of potential chemical concentrations in more distant sport fisheries such as Settlement Canyon Reservoir. Rainbow Reservoir is at DCD and was stocked and opened to the public for a short time in 2001. Rainbow Reservoir was scheduled to be open for six months per year, but because of security concerns, Rainbow Reservoir is closed indefinitely. Rainbow Reservoir cannot be a source of potential mercury exposures if Rainbow Reservoir remains closed. Nor can Rush Lake be the source of potential mercury exposures unless climate conditions change to allow a sport fishery to develop. Predicted mercury concentrations in fish at Settlement Canyon reservoir would be much lower because of the increased distance from the smokestack.

Mercury emissions are concluded to be safe because:

- The largest potential mercury source, the brine reduction area, does not operate. The brine reduction area is not anticipated to operate in the future. Emission testing will be conducted and evaluated prior to the brine reduction area being permitted for operation.

- Enhanced characterization efforts for GB and reduced mercury feed rates indicate that the risk assessment overestimates mercury emissions. The enhanced characterization efforts will continue for the VX and mustard campaigns.

- People were assumed to eat fish from Rush Lake and Rainbow Reservoir. Rush Lake does not support a fishery and Rainbow Reservoir is closed to fishing. If Rainbow Reservoir is reopened, the fish consumption for recreational fishers was overestimated.

- Mercury levels in soil and fish will be monitored to confirm that mercury is not being released from stack emissions at unsafe levels. Additional details on monitoring are provided in the Future Actions section.

Comparison to the 1996 Screening Risk Assessment

The 1996 *Screening Risk Assessment* identified potential releases of dioxins as safe but potentially approaching unsafe levels. Due primarily to improved analytical testing methods and elimination of the dunnage incinerator, potential health risks from dioxin emissions from the TOCDF are lower than predicted by the *Screening Risk Assessment*. The dunnage incinerator was not included in the TOCDF permit renewal application and will not be operated.

The 1996 *Screening Risk Assessment* did not include an evaluation of potential dioxin exposures to infants from breast milk. Although no significant advancements have

occurred in the methods used to evaluate this potential exposure pathway, the U.S. EPA (1998) now recommends that the pathway be included in hazardous waste incinerator risk assessments. This risk assessment evaluated the pathway and concludes that potential exposures to a breast-feeding infant to dioxins from the TOCDF and CAMDS are safe.

Future Actions

Many of the emission estimates for the TOCDF and CAMDS were extrapolated using methods that intentionally overestimate emissions. Future stack testing will be conducted to verify actual emissions. The enhanced waste characterization efforts that were used for the GB campaign are anticipated to be continued through the VX and HD campaigns. The information collected as part of these efforts will be compared to the assumptions made for this risk assessment.

Prior to the TOCDF beginning full-scale agent operations in 1996, samples of soil and vegetation were collected from around DCD to establish baseline concentrations. Periodic sampling has been conducted to monitor for potential increases in chemical concentrations in the environment. This sampling is anticipated to continue and analyses of fish from Rainbow Reservoir will be added to the sampling program. The monitoring data that is currently available, while not conclusive, does not indicate an increase in chemical concentrations around DCD. If, contrary to the conclusions of this risk assessment, chemical concentrations in the environment become higher than predicted, the monitoring program would detect any increases.